USER MANUAL

INSTALLATION INSTRUCTIONS
WIRING DETAILS
CALIBRATION
MAINTENANCE

VA30IEM

VA30IEMRP

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1. INTRODUCTION

1.1 DESCRIPTION

In continuing with its commitment towards cutting-edge technology and customer satisfaction, Vulcain introduces a breakthrough innovation in Refrigerant, toxic and Combustible Gas Monitoring.

The result of extensive research and design, the VA301EM uses the latest in infrared technology. The remote sensor allows for accurate monitoring of the lowest gas concentration. This sensor can be placed at a distance of up to 500 feet for toxic and combustible gas monitoring and 200 feet for refrigerant gas monitoring from the transmitter.

The transmitter is equipped with a backlight LCD display and keypad that can be placed at eye level and in a different location from the refrigerant gas reading area. Thus allowing the monitoring from a safe and remote location.

Furthermore, it offers 4@20mA outputs, relay outputs, Modbus communication, audible alarm options and it is compatible with our VA301C controller.

1.2 INTENDED USE

Refrigerant availability and increasing refrigerant cost makes refrigerant surveillance a necessity for people managing equipment rooms. Having a Vulcain refrigerant monitor provides early warning of refrigerant loss, enhancing a refrigerant conservation strategy while indicating mechanical equipment room refrigerant concentrations. Moreover, toxic and combustible sensors can be tied in the VA301EM to meet the broadest range of customer requirements. Available in a special configuration, the VA301EM Expansion Module has been carefully designed to meet and even exceed the B-52 and ASHRAE 15-2001 standards.

1.3 UNPACKING

After opening the package, remove the equipment and components. Please make sure that all the items described on the order form or packing slip **are actually in the box and are undamaged.**

2. INSTALLATION INSTRUCTIONS

2.1 INSTALLATION GUIDELINES

These guide lines **must be strictly observed** to assure that the equipment will work properly. If they are not applied, Vulcain will not recognize any liability in case of improper operation:

- Make sure to locate all units easily accessible for proper service.
- Avoid any location where units could be subject to vibrations.
- Avoid any location close to any electromagnetic interference.
- Avoid any location where there are large temperature swings.
- Verify local requirements and existing regulations witch may affect the choice of location.

2.2 SURFACE-MOUNT INSTALLATION

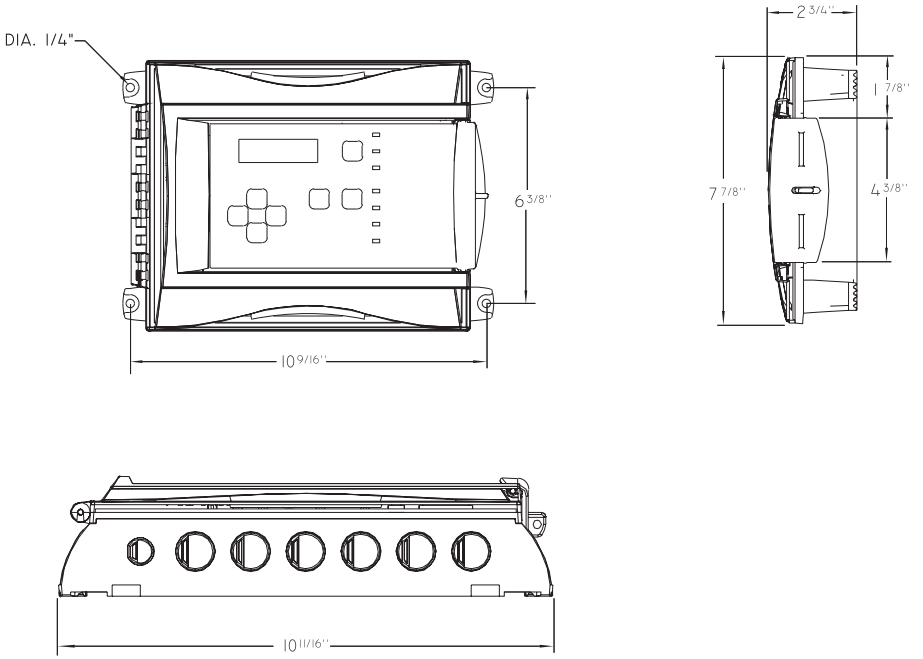


Table 1
Recommended Height

Detected Gas		Relative Density (air = 1)	Installation Height
CO	Carbon Monoxide	0.968	3 - 5 ft. (1 - 1.5 m) from floor
***NO_2**	Nitrogen Dioxide	1.58 (cold)	1 - 3 ft. (30 cm to 1 m) from ceiling
H_2	Hydrogen	0.07	1 ft. (30 cm) from ceiling
CL_2	Chlorine	2.50	1 ft. (30 cm) from floor
H_2S	Hydrogen Sulfide	1.19	1 foot (30 cm) from floor
O_2	Oxygen	1.43	3 - 5 ft. (1 - 1.5 m) from floor
HCL	Hydrogen Chloride	1.30	1 foot (30 cm) from floor
HCN	Hydrogen Cyanide	0.932	1 ft. (30 cm) from ceiling
ETO	Ethylene Oxide	1.50	1 foot (30 cm) from floor
SO_2	Sulfur Dioxide	2.25	1 foot (30 cm) from floor
R11	Refrigerants	5.04	1 foot (30 cm) from floor
R12		4.20	
R22		3.11	
R123		5.27	
R125		4.14	
R134A		3.52	
COMB	Most combustibles are heavier than air, with the exception of methane, hydrogen,ethylene and acetylene. For gases that are heavier than air, sensors should be installed approximately 30 cm (1 foot) from the floor. For combustibles that are lighter than air, sensors should be installed 30 cm (1 foot) from the ceiling, close to the potential leak source.		

* May differ in certain applications. Hot NO_2 from exhaust systems is lighter than ambient air.

2.3 DETERMINATION OF THE NUMBER OF TRANSMITTERS

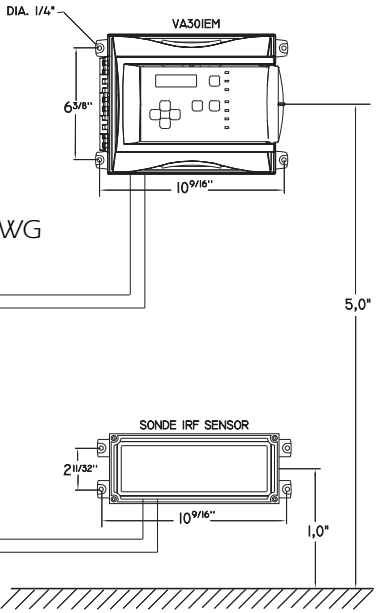
The number of units required to protect the area is determined by the radius of coverage of the unit. This radius depends on the gas to be detected and is given by Table 2.

Table 2
Radius of Surveillance

Gas Detected		Radius of Surveillance	Area Covered
CO **NO_2**	Carbon Monoxide Nitrogen Dioxide	50 ft. (15 meters)	7,854 square ft. (707 square meters)
Others		23 ft. (7 meters)	1,257 square ft. (154 square meters)

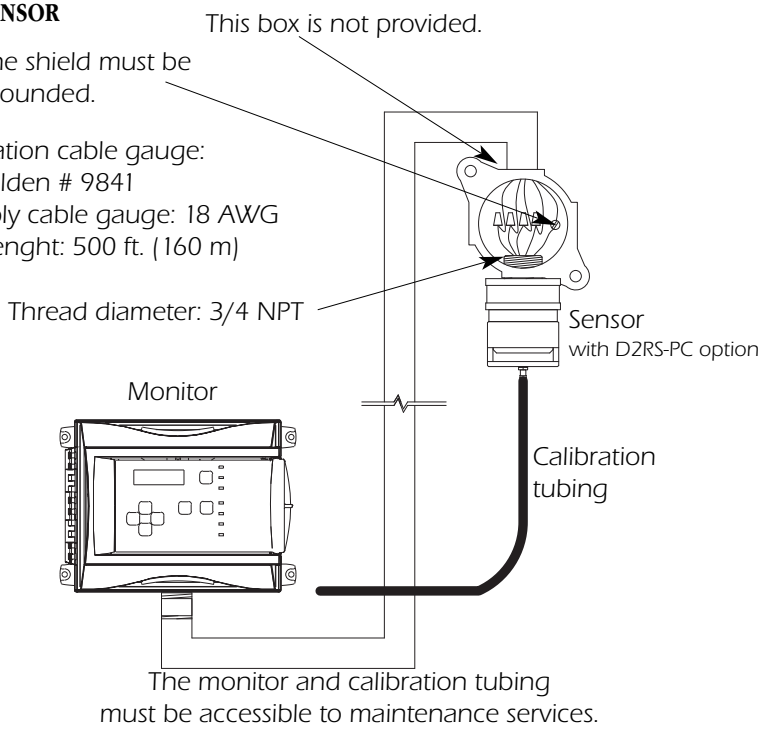
2.4 OPTIONAL REMOTE SENSORS MOUNTING

VA301IRFS REMOTE SENSOR



Communication cable gauge:
24 AWG Belden # 9841
Power supply cable gauge: 14 AWG
Maximum lenght: 200 ft. (60 m)

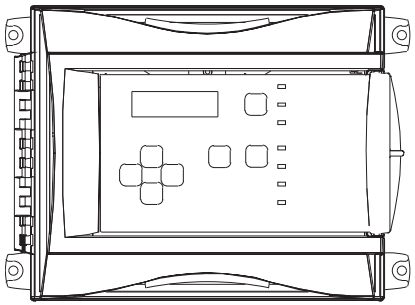
S301D2 REMOTE SENSOR

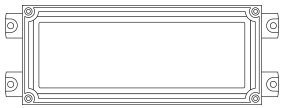

This box is not provided.
The shield must be grounded.
Thread diameter: 3/4 NPT
Sensor
with D2RS-PC option
Monitor
Calibration tubing
The monitor and calibration tubing must be accessible to maintenance services.

Communication cable gauge:
24 AWG Belden # 9841
Power supply cable gauge: 18 AWG
Maximum lenght: 500 ft. (160 m)

3. WIRING DETAILS

3.1. SYSTEM WIRING





IRFS SENSOR

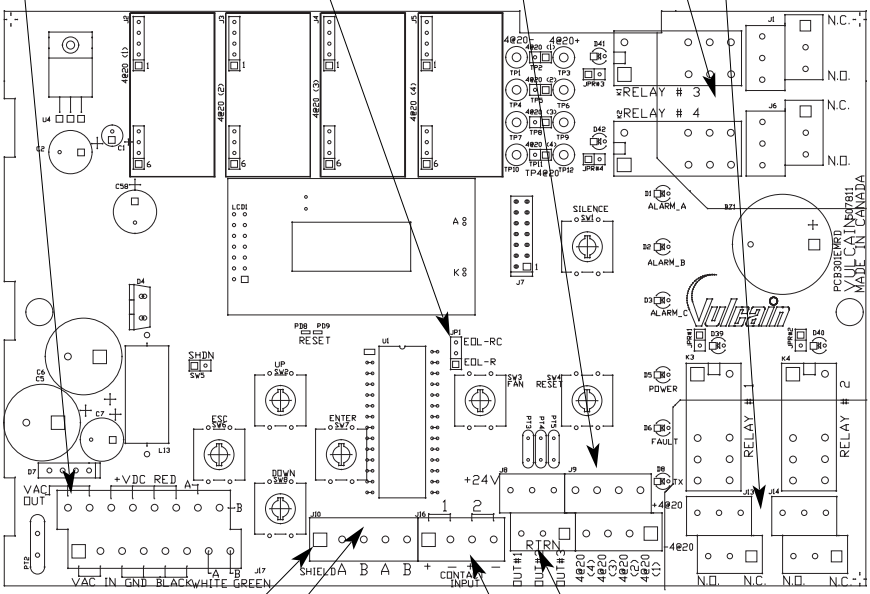
S301D2 SENSOR
with D2RS-PC option

Power:
J17
22 to 27 Vac,
29to 38 Vdc,
2.0 A max

End of line:
JP1 To determine a transmitter to be the last in the network, place the jumper in an upright aligned with the top

4@20 mA: J9

Relay Output:
J13, J14, J1, J6
5 A, 30 Vdc
or 250 Vac
(resistive load)



Communication Shield

Input Contact: J16
Input for manual switch

Communication: J10

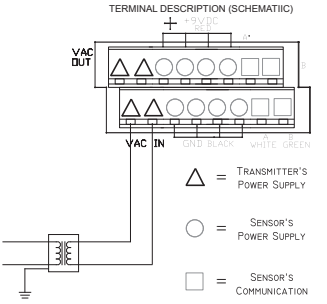
Length of line: Up to 2000 feet (600 m) from controller
T-tap : 65 ft. (20 m) maximum per t-tap
130 ft. (40 m) total

From controller or previous unit
To next unit if applicable.

Output 24 Vdc: J8
Three 24 Vdc outputs (can be use to activate horn, strobe, etc.)

3.1.1 Power:

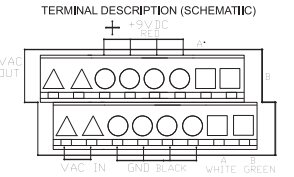
The power requirement range is 22-27 Vac, 29-38 Vdc, 2.0 A max. In both AC or DC mode, the polarisation is not important. The system must be grounded on the transformer. **A dedicated circuit-breaker should be used.**

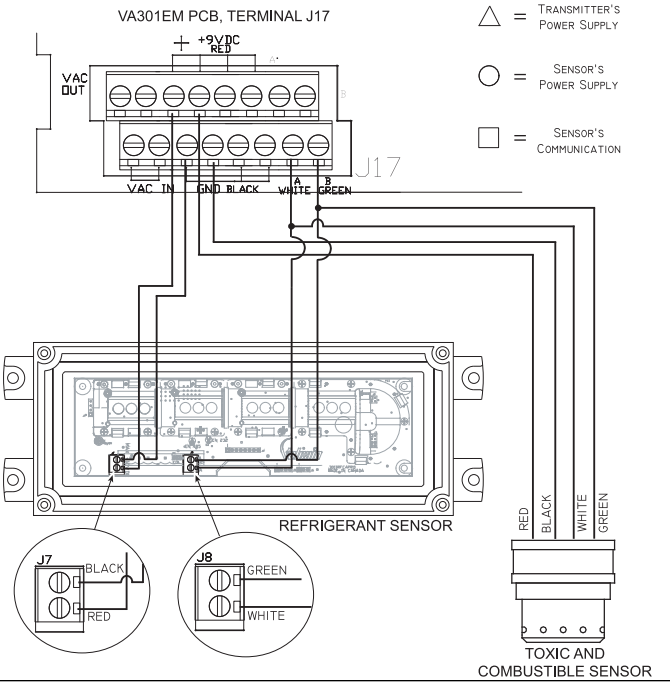


3.1.2 Connect sensor to transmitter:

Connect the sensor to the transmitter using the diagram below. The maximum distance between sensor and transmitter is 200 ft. (60 m) for refrigerant and 500 ft. (160 m) for toxic and combustible gases. Use twisted and shielded cable **#24/2 AWG (Belden #9841)** for the Sensor's Communication (green and white). Use standard wires **#18 AWG** for Toxic and combustible Sensor's Power Supply (black and red) and wires **#14 AWG** for refrigerant Sensor's power supply (black and red). Color code (black, red, green, white) has to be respected.

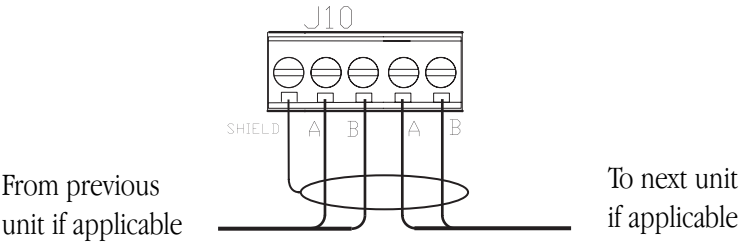
Each sensor needs to be supplied with separate wires and needs to be connected directly on the VA301EM. However same communication terminals can be shared.





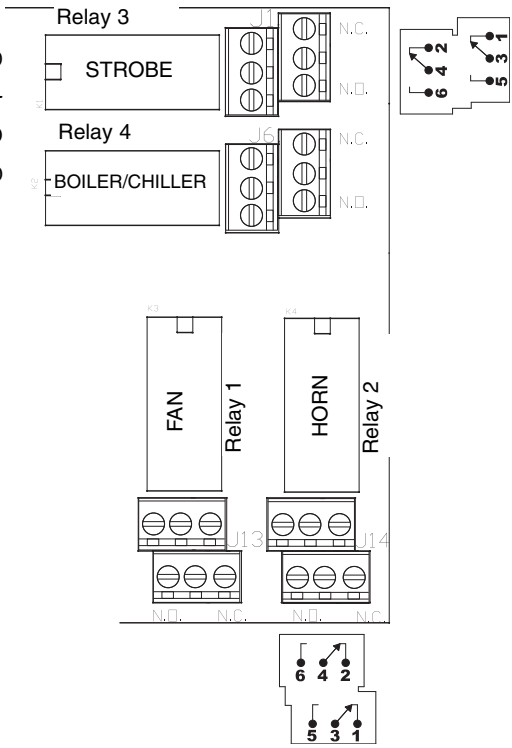
3.1.3 Communication (if connected on a controller network), J10:

The communication cables have to be grounded using the shield terminal. Use twisted and shielded cable **#24/2 AWG (Belden 9841)** for the connection. The network can be up to 2000 ft. (600 m) per channel. The lenght of a T-tap can be a maximum of 65 feet (20 m). A maximum of 130 ft. (40 m) for all the T-tap must be respected.



3.1.4 Relay Outputs:

The relays outputs will withstand up to 5 amps at 30 Vdc or 250 Vac (resistive load only). They can be used to activate horns, strobes, etc. Refer to drawing below for proper wiring.



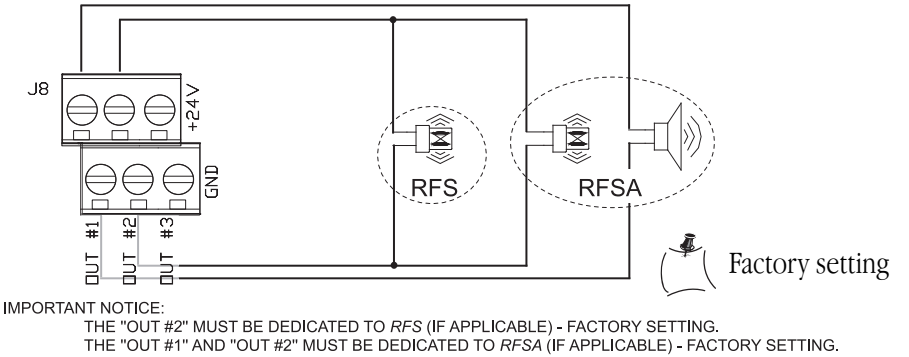
FailSafe Relay

FailSafe relays are activated with the unit. That way, electrical failures can be detected putting the system on alarm. The default setting for VA301EM is normal mode (No FailSafe). *The VA301EMRP setting is a copy of the VA301EM programmation, including accessories activation.*

See APPENDIX section for more details about B-52 and ASHRAE standard configuration.

3.1.5 Output 24 Vdc, J8

The three 24 Vdc / 250 mA outputs are provided to activate DC horn, strobe, etc.



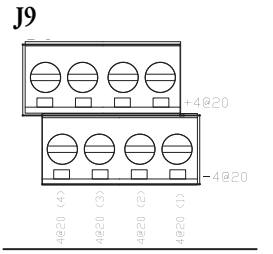
IMPORTANT NOTICE:
THE "OUT #2" MUST BE DEDICATED TO *RFS* (IF APPLICABLE) - FACTORY SETTING.
THE "OUT #1" AND "OUT #2" MUST BE DEDICATED TO *RFSA* (IF APPLICABLE) - FACTORY SETTING.

RFS: Optional built-in stobe
RFSA: Optional built-in stobe and horn

3.2 4@20 mA CONFIGURATION

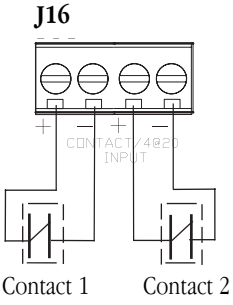
3.2.1 Output 4@20 mA, J9:

The 4@20 mA output option will provide a real time analog readout of the gas concentration read by the VA301EM for each of its sensors. It can be connected to a third party controller, DDC, BMS, etc. Polarity must be observed. Do not apply electrical power to the VA301EM until all connections are made.



3.2.2 Contact Input, J16

The contact input is mainly used to connect a manual break glass switch to comply with the mechanical code. It is also possible to connect a third break galss switch in series if needed.

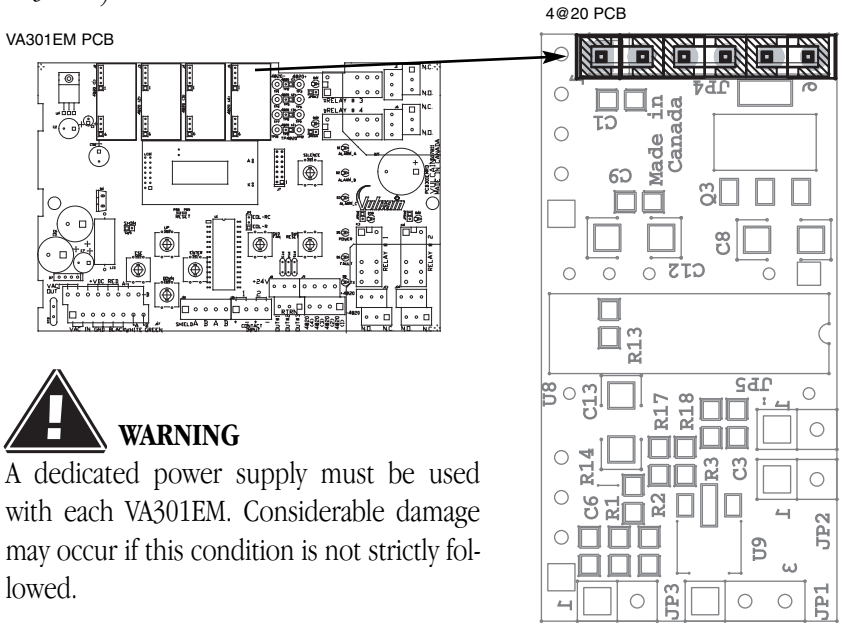


Contact 1 = Electrical shut down (ASHRAE 15 config.)
Contact 2 = Fan activation (ASHRAE 15 config.)

3.2.3 4@20 OUTPUT CONFIGURATION

4@20 mA CURRENT SOURCING OUTPUT CONFIGURATION

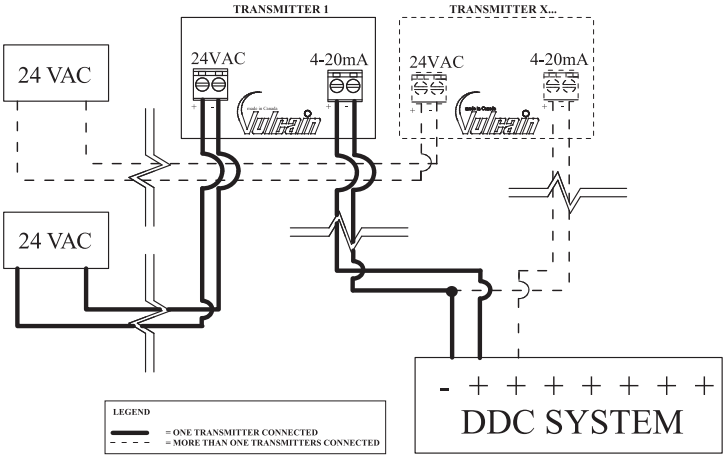
The transmitter supplies the loop current. The maximum impedance supported by the loop is 400 ohms. Set jumpers on JP4 at 1-2, 3-4 and 5-6 (VA301EM, VA301IRF and VA301D2).



WARNING

A dedicated power supply must be used with each VA301EM. Considerable damage may occur if this condition is not strictly followed.

Current Sourcing Output Configuration



4@20 mA OUTPUT LOOP-POWERED OPERATION
(Factory Setting)

The 4@20 mA output is factory set for loop-powered operation and requires a power source of 12 Vdc to 30 Vdc. The overall impedance depends on the voltage supplied at the 4@20 mA loop. Set jumpers on JP4 at 2-3, 4-5 and 6 for this type of configuration.

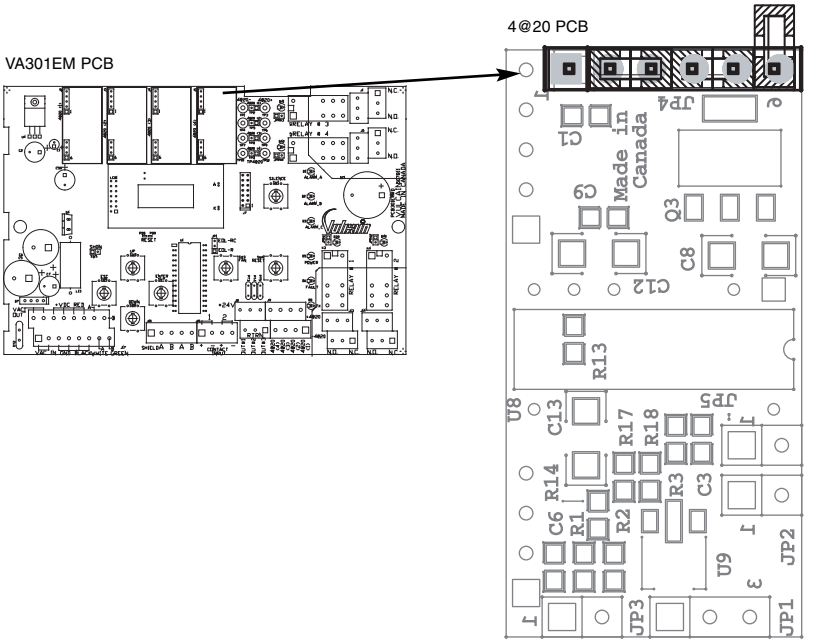
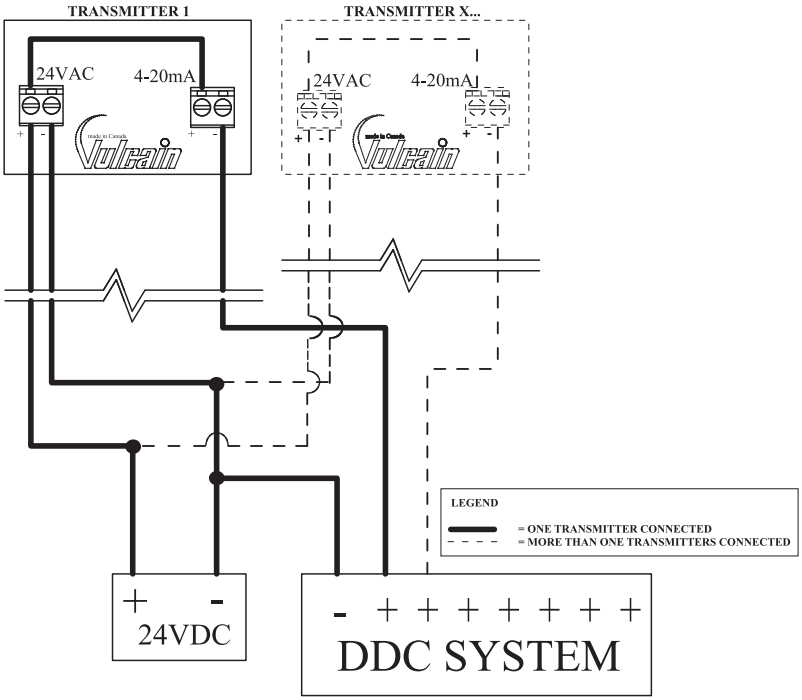


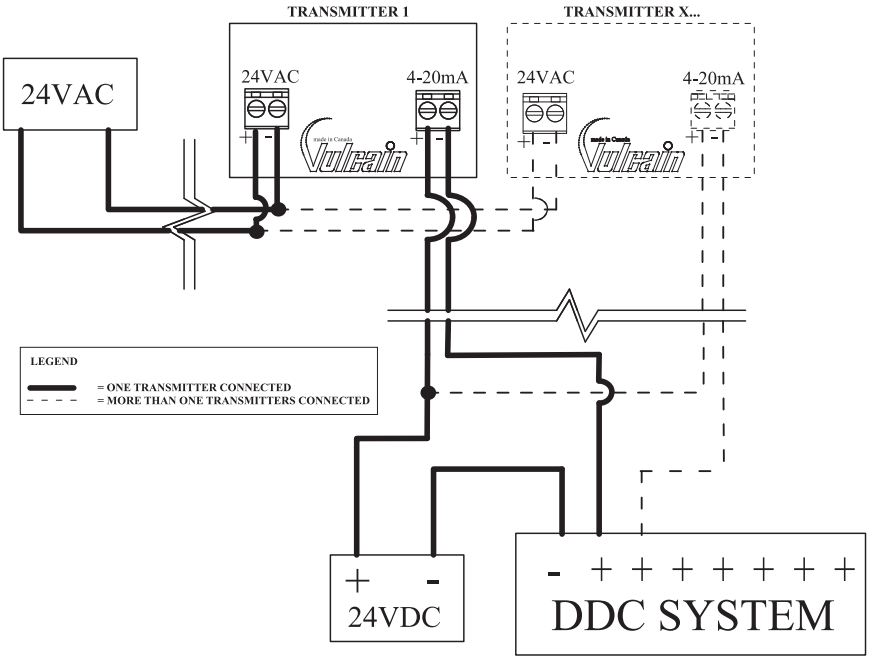
Table 3
Permitted Impedance in the 4@20 mA Loop

Voltage Source Applied	Total Impedance
12 Vdc	400 Ohms
16Vdc	600 Ohms
20 Vdc	800 Ohms
24 Vdc	1,000 Ohms
30 Vdc	1,300 Ohms

3 wires configuration

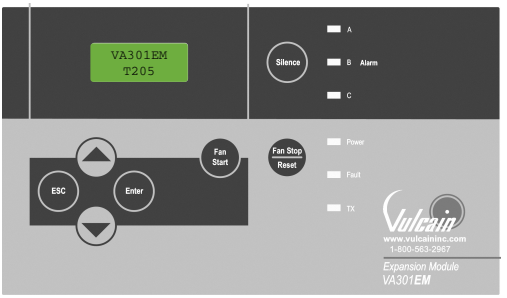


4 wires configuration



4. CALIBRATION / PROGRAMMING

4.1 USER INTERFACE



When power is initially applied, the unit will display the product's name and firmware's revision.

4.2 OPERATING MODE

Normal Mode: In normal mode, no input from the end-user is required. The display will scroll between the sensors (up to 4) and will show the gas name & gas concentration. The Tx LED will blink when data is send on the communication channel (if connected to a controller).

Alarm Mode: The corresponding red alarm LED (A, B or C) will lit in case of a gas leak for a given sensor. The Silence key can be used to turn off the relays/buzzer if programmed accordingly. The *Reset key* is used to acknowledge an alarm when the VA301EM is programmed to comply with the B-52/ASHRAE 15 mechanical code.

Fault Mode: If a communication problem occurs with one of the sensors, the yellow fault LED will be on. The servicing alarm will also turn on the fault LED.

Programming Mode: The programming mode is password protected and should only be accessed by a certified technician. Pressing the *Enter Key* will put the VA301EM in programming mode. The *Scroll keys* are used to move around the menus and input programming values. ESC key will cancel an input or exit the programming menu.

4.3 KEY DEFINITION

ESC Key:	Use the *ESC Key* to exit the menus or cancel an input. Use it also to stop the alternating reading between the connected sensors.
Scroll Keys (Up/Down):	Use the *Scroll Keys* to scroll the menus or to select a specific value.
Enter Key:	Use the *Enter Key* to enter a programming field or to validate a specific value.
Fan Start Key:	Control relay #1 (Fan) (For B-52 or ASHRAE 15 programmation). See Events Tables.
Fan Stop/Reset Key:	The *Reset Key* enable the user to reset the alarm or the relay # 1. (For B-52 or ASHRAE 15 programmation). See Event Tables.
Silence Key:	Turns off the buzzer and horns

4.4 SPECIFICATIONS

4.4.1 TRANSMITTER VA301EM

Standard Outputs:	4 DPDT relays 3 Outputs at 24 Vdc @ 250 mA each	
Optional Outputs:	4@20 mA for each sensor RS-485: Modbus or Vulbus	
Audible Alarm:	65 dBA @ 3 foot (1 m)	
Display :	Backlit LCD	
Visual Indicators:	Green LED:	Normal operation
	Red LEDs:	Alarm A, B and C
	Yellow LED:	Fault/service alarm
	Amber LED:	Tx
	(Activated in network mode)	
Maximum distance between VA301EM and Controller:	Up to 2000 feet (600 m) T-tap: 65 ft. (20 m) maximum per t-tap 130 ft. (40 m) total	
Relay Output Rating:	5A, 30Vdc or 250Vac (resistive load)	
Circuit Protection:	Long Time-Lag Polyswitch Type TT	
Overvoltage Category:	II	
Power Requirement:	22-27 Vac, 50 or 60 Hz, 29-38Vdc, 2.0 A max @ 29 Vdc	
Operating Environnement:	Indoor Use	
Operating Temperature Range:	32°F to 100°F (0 to 40°C)	
Operating Humidity Range:	0 to 95% RH (non-condensing)	
Operating Altitude:	Up to 9843 feet (3,000 m)	
Enclosure:	ABS - Polycarbonate	
Pollution Degree:	2	
Transmitter Size:	7.99" (H) x 11.02"(W) x 2.76" (D) (20.3 x 28 x 7 cm)	
Transmitter Weight:	2.26 lbs (1.02 kg)	
Optional Horn:	105dBA, 4-28V, 2800Hz (RFSA) Min. Voltage 80 dB(A) min. @ 2 FT and 6 Vdc Max Voltage 90 dB(A) min. @ 2 FT and 28 Vdc	
Optional Strobe:	STAS flashing LED, 24VAC/VDC	

4.4.2 SENSOR VA301IRFS

Gases Detected:	R-11, R-12, R-22, R-123, R-125 and R-134a (other mixes also available)
Sensing Technology:	Vulcain infrared sensor
Measurement Range:	0-1000 PPM
Resolution:	1 PPM
Response Time (T90):	60 seconds
Cold to Start:	4 hours
Operating Environnement:	Indoor Use
Distance between VA301EM and Sensor:	Up to 200 feet (60 m)
Operating Temperature Range:	32°F to 100°F (0 to 40°C)
Operating Humidity Range:	0 to 95% RH (non-condensing)
Operating Altitude:	Up to 9843 feet (3,000 m)
Enclosure:	ABS - Polycarbonate
Size:	4.02" (H) x 11.02"(W) x 2.48" (D) (10.2 x 28 x 6.3 cm)
Weight:	2.33 lbs (0.603 kg)

The VA301EM sensor LED has 2 functionalities. If the sensor is working properly, the LED will blink according to the sensor addresses on the VA301EM. In that case, the LED will blink as shown below:

Address 1 = The LED blink 2 times during 2,8 seconds
Address 2 = The LED blink 3 times during 2,8 seconds
Address 3 = The LED blink 4 times during 2,8 seconds
Address 4 = The LED blink 5 times during 2,8 seconds

If the sensor is connected to a VA301IRF, the LED will be on during 0,2 seconds and off during 2,6 seconds (blinking).

If the sensor has a problem (failsense), the LED will go on steady

4.4.3 SENSOR VA301D2

Sensing technology:	Electrochemical (toxic) Catalytic combustion (combustible) Diffusion fuel cell (oxygen)
Distance between VA301EM and Sensor:	Up to 500 feet (160 m) (toxic and combustible)
Operating Temperature Range:	Toxic: -40°F to 100°F (-40 to 40°C) Combustible: -40°F to 112°F (-40 to 50°C)
Operating Humidity Range:	0% to 95% RH, Non-Condensed
Operating Altitude:	Up to 9843 feet (3,000 m)
Enclosure:	Class 1, Division 1, Groups B, C, D

4.5 RANGE AND ALARM LEVELS

Table 4
Range and Alarm Level

Gas Detected		Range	Alarm A	Alarm B	AlarmC
CO	Carbon Monoxide	0 - 250 PPM	25 PPM	200 PPM	220 PPM
NO_2	Nitrogen Dioxide	0 - 10 PPM	0.72 PPM	2 PPM	9 PPM
H_2	Hydrogen	0 - 100% LEL	25% LEL	50% LEL	90% LEL
CL_2	Chlorine	0 - 15 PPM	0.5 PPM	1 PPM	13.5 PPM
SO_2	Sulfur Dioxide	0 - 10 PPM	2 PPM	5 PPM	9 PPM
H_2S	Hydrogen Sulfide	0 - 50 PPM	10 PPM	15 PPM	45 PPM
HCL	Hydrogen Chloride	0 - 25 PPM	3 PPM	4 PPM	22.5 PPM
HCN	Hydrogen Cyanide	0 - 50 PPM	5 PPM	9 PPM	45 PPM
ETO	Ethylene Oxide	0 - 20 PPM	1 PPM	5 PPM	18 PPM
O_2	Oxygen	0 - 25% Vol.	19.5% Vol.	22% Vol.	22.5% Vol.
R-123	Refrigerant	0 - 1,000 PPM	50 PPM	500 PPM	900 PPM
R-11 **R-12** **R-22** **R-125** **R134A**	Refrigerant Q1	0 - 1,000 PPM	250 PPM	500 PPM	900 PPM
COMB	Combustibles	0 - 100% LEL	25% LEL	50% LEL	90% LEL

A different alarm level may have been programmed in order to satisfy the constraint of a particular application.

5. MAINTENANCE

The VA301EM is a maintenance free controller. Only the sensors need periodic inspection and calibration.

5.1 PERIODIC INSPECTIONS AND CALIBRATION

Vulcain provides its customers with specialized gas detection equipment. Beyond the warranty period, the systems must be maintained and calibrated on a regular basis (normally two times a year).

Only Vulcain's certified personnel are authorized to accomplish this work. Vulcain will not assume responsibility for the interruption of service or malfunctioning of its equipment as a result of the discontinuance of maintenance and calibration services.

An up-to-date list of authorized technical centers is available from Vulcain's Technical Support.

If unit span or zero cannot be adjusted, the sensor may be approaching its end-of-life and must be replaced. Keep an operation log of all maintenance, calibrations and alarm events.

5.2 REPLACEMENT PARTS

5.2.1 LED replacement instructions for RFS or RFSA option:

- Turn the diamond on the cap until it is align on the black diamonds;
- Pull off the cap;
- Use the insertion tool to remove the LED;
- Use the insertion tool to put in the new LED;
- Put on the cap;
- Turn the diamond until it is align on the white diamonds.

Due to continuous evolution of our products, please contact our service department for ordering parts or for more details.

5.3 CLEANING

Clean the exterior with a soft, damp cloth. Do not use solvents, soaps or polishers.

6. APPENDIX

AVAILABLE PRE-PROGRAMMED CONFIGURATIONS

Table 5
Type1 CND (B-52 Canadian Standard for R123)

SetEvent	Input	Status	Output	Reset	Silence
Event# 1	SD All	Alr A	Relay #1	Yes	No
Event# 2	SD All	Alr A	Relay #4	Yes	No
Event# 3	SD All	Alr A	Out 1	Yes	Yes
Event# 4	SD All	Alr A	Out 2	Yes	No
Event# 5	SD All	Alr A	Out 3	Yes	No
Event# 6	SD All	Alr A	Buzzer	Yes	Yes
Event# 7	SD All	Alr A	Relay #2	Yes	Yes
Event# 8	SD All	Alr A	Relay #3	Yes	No
Event# 9	SD All	Fault	Relay #3	Yes	No
Event#10	SD All	Alr B	Relay #1	No	No
Event#11	SD All	Alr C	Relay #1	No	No

Table 6
Type2 CND (B-52 Canadian Standard for other Refrigerants)

Event	Input	Status	Output	Reset	Silence
Event# 1	SD All	Alr A	Relay #1	Yes	No
Event# 2	SD All	Alr A	Out 1	Yes	Yes
Event# 3	SD All	Alr A	Out 2	Yes	No
Event# 4	SD All	Alr A	Out 3	Yes	No
Event# 5	SD All	Alr A	Buzzer	Yes	Yes
Event# 6	SD All	Alr A	Relay #2	Yes	Yes
Event# 7	SD All	Alr B	Relay #4	Yes	No
Event# 8	SD All	Alr A	Relay #3	Yes	No
Event# 9	SD All	Fault	Relay #3	Yes	No
Event#10	SD All	Alr C	Relay #1	No	No

Table 7
Type3 US (ASHRAE 15 Standard for Refrigerants)

Event	Input	Status	Output	Reset	Silence
Event# 1	SD All	Alr A	Relay #1	Yes	No
Event# 2	SD All	Alr A	Out 1	Yes	Yes
Event# 3	SD All	Alr A	Out 2	Yes	No
Event# 4	SD All	Alr A	Out 3	Yes	No
Event# 5	SD All	Alr A	Buzzer	Yes	Yes
Event# 6	SD All	Alr A	Relay #2	Yes	Yes
Event# 7	SD All	Alr B	Relay #4	No	No
Event# 8	SD All	Alr A	Relay #3	Yes	No
Event# 9	SD All	Fault	Relay #3	No	No
Event#10	[1]ManSw #1	Open	Relay #1	Yes	No
Event#11	[1]ManSw #1	Open	Relay #4	Yes	No
Event#12	[1]ManSw #1	Open	Out 1	Yes	Yes
Event#13	[1]ManSw #1	Open	Out 2	Yes	No
Event#14	[1]ManSw #1	Open	Out 3	Yes	No
Event#15	[1]ManSw #1	Open	Buzzer	Yes	Yes
Event#16	[1]ManSw #1	Open	Relay #2	Yes	Yes
Event#17	[1]ManSw #1	Open	Relay #3	Yes	No
Event#18	SD All	Alr C	Relay #1	No	No
Event#19	[2]ManSw #2	Open	Relay #1	No	No

[1] Mansw #1 Trigger off an electrical shut down.
[2] ManSw #2 Trigger off relay #1.